

39

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
Washington 25, D. C.

THE SCREW-WORM PROBLEM IN FLORIDA

and

COMMENTS ON ERADICATION

By

W. G. Bruce

Plant Pest Control Division

and

T. W. Cole

Animal Disease Eradication Division

March 1, 1957

Summary

The current screw-worm situation in Florida is, according to all reports, the worst since this pest entered the State in 1933. The period from June 1, 1956 to mid-February 1957 has been one of high populations and continuous screw-worm activity. It has been estimated that 80 to 85 percent of all wounds in livestock have been infested during that period. The average annual loss due to screw-worm attack, in Florida, is estimated to be not less than 10 million dollars. The losses in 1956 may have been in excess of that amount.

It is believed that a Federal-State cooperative program, using sterile male screw-worm flies to overwhelm natural fly populations and the rigid enforcement of proposed quarantines, would effectuate eradication of the screw-worms in the Southeast. Such a program could very probably be completed by the end of two full operating years, not including the time required for construction of buildings and facilities. Weather conditions, particularly during the winter months, may shorten or prolong this estimated time period for the completion of the program. The total cost of an eradication program would approximate 9 to 10 million dollars.

After completion of the eradication program, it will be necessary to maintain constant vigilance to prevent reinfestations in the screw-worm-free area. This means the enforcement of quarantines; inspection of all livestock entering the Southeast from the west; continuous screw-worm surveys; and being ready to promptly eradicate an incipient infestation. This operation will cost an estimated \$750,000 annually.

A screw-worm control program, in lieu of an eradication program, is not recommended. However, progressive relief from screw-worm attack would be obtained by the early initiation of large-scale pilot tests and expanding such operations as rapidly as facilities develop for the all-out eradication program.

THE SCREW-WORM

The screw-worm is a true parasite and, in nature, lives only in the living flesh of warm-blooded animals. Worms found in turtles, snakes, lizards and other cold-blooded animals, and those found in carcasses, dead fish, decaying meats and decaying vegetable matter are common blowflies. Any warm-blooded animal is susceptible to screw-worm attack. Infestations have been found in practically all kinds of wild and domestic animals, poultry, and in man.

Before the screw-worm fly will lay its eggs on an animal, there must be a disruption in the continuity of the body surface. The opening through which the screw-worm enters the flesh may be as small as a tick bite; it may be through the navel cord of a new-born animal, a scratch, a surgical operation, or some diseased condition of the skin or mucus membrane. Any open wound is attractive to the female screw-worm fly and infested wounds become increasingly attractive; consequently, the wound constantly receives new batches of eggs.

The female screw-worm fly deposits her eggs in shingled batches on the edges of wounds of warm-blooded animals. She may deposit as few as 10, or as many as 400 eggs at one time. The eggs of the screw-worm can be distinguished from those of other blowflies by the fact that they are placed in shingle-like batches and are cemented together, while the eggs of the ordinary blowflies are placed in haphazard fashion and are not securely cemented together.

The eggs hatch in from 6 to 21 hours. The larvae eat into the live flesh, feeding in clusters and soon form a "pocket" in the flesh. After completing development, which takes from 4 to 10 days, the screw-worms drop from the wound and burrow into the soil where the outer skin hardens and forms a pupa. Seven to fourteen days later, the adult fly emerges and in about four days it is ready to mate and lay eggs. During cool weather the pupal state may persist for two months. The average life cycle of the screw-worm is approximately 24 days.

History of the Screw-Worm in the United States

Screw-worms have been known in Texas since about 1842. Occasionally, during the summer, they spread to adjoining states, but the subsequent cold weather during the winter months usually killed all but those in south Texas. Screw-worms were unknown in the Southeast until the summer of 1933 when the first infestations were reported in the vicinity of Boston, Ga. By the end of that year, infestations spread southward to 30 counties in Southern Georgia and 18 to 20 counties in Northern Florida. During the following year screw-worms spread to 35 additional counties in Florida and by early summer of 1935 screw-worms were found in every Florida county except Monroe on the southernmost tip of the peninsula. Heavy losses of livestock from screw-worm attack were reported by hundreds of frantic stockmen.

An intensive Screw-worm Educational and Control Program, sponsored by the Bureau of Entomology and Plant Quarantine and the several State Extension Services, was in progress from June 1935 to the spring of 1938, and resulted in a drastic reduction in screw-worm populations. However, in subsequent years, the screw-worm population again built up to serious proportions in Florida with frequent summertime spread to Georgia, Alabama, and South Carolina.

Distribution and Relative Abundance of Screw-Worms in Florida in 1956

Screw-worms, during 1956, were prevalent throughout peninsular Florida and westward to include the counties of Jackson, Calhoun, and Gulf. Heavy screw-worm fly populations built up by the latter part of May, and the period from June 1956 until mid-February 1957 evidently was more serious, from the standpoint of infestations in wild and domestic animals, than during any similar period in Florida. Infestations during the summer and early fall were probably no worse than similar periods of some other year but the unusually mild fall and winter permitted continuous screw-worm activity, and consequent heavy infestations throughout peninsular Florida. Stockmen in this area have estimated that 80 to 85 percent of all wounds were infested during the past 10 months.

The summer migration of screw-worms from Florida extended northward to include the southern seven counties of South Carolina, approximately the southern half of Georgia, and the southeast corner of Alabama. (See attached map.)

Present Status of Screw-Worm Infestations in Florida

The screw-worm situation in Florida, in early February, was determined by reports from the Florida Livestock Association, personal interviews with members of the Florida State Livestock Board, and visits with a number of prominent stockmen, and others, throughout central Florida. In general, it can be reported that the screw-worm situation in Florida is serious and about 75 to 85 percent of all wounds on livestock are infested. A few specific references and the source of the information follow:

J. O. Pearce (Okeechobee), President of the State Cattlemen's Association reported that screw-worm infestations are worse this winter than for any previous winter; that the Association has estimated the cost of labor alone to treat infestations amounts to \$3,381,980.00 or \$2.30 per head per year; that even though stockmen try to treat every infestation, they are losing about 1 percent of the animals; that navel infestations in calves, even though treated, often result in stunted animals or in cases of "swollen joints" - a disease predisposed by screw-worm flies.

J. R. Gunn (Kissimmee), Secretary, Florida Cattlemen's Association reported that, even though he promptly treats the navels of all his newborn calves to prevent infestations, he still gets some infestations.

Cecil Tucker (Fort Christmas) stated that this has been the worst winter for screw-worm infestations. He believes that 100 percent of all wounds are infested.

Henry Partin (Kissimmee) reported this to be the worst winter for screw-worms; that while most stockmen treat every infestation they can find, many infested animals hide out in the brush and cannot be treated; that some cattlemen are not treating infested animals; that during the past month his sons shot three deer heavily infested with screw-worms.

Roscoe Bass, stockman, reported that screw-worms have become so bad that he will have to give up raising calves because he cannot afford the expense of treating screw-worms; that riders cost \$12.00 to \$15.00 per day and are difficult to find; that there have been no lulls in the activity of the screw-worm during the past 10 months; that controlled breeding, to have calves drop in the winter months to avoid most infestations, was ineffective this year.

Jay B. Starkey (St. Petersburg), Chairman, State Livestock Board, reported treating 90 infestations in his last 125 calves. He also stated that controlled breeding had very little beneficial effect this year.

D. B. Kibler (Lakeland) reported that he loses about \$1500 worth of bulls each year from screw-worm attack; that three-fourths of his riders' time is presently occupied in treating screw-worm infestations; that 90 percent of his newborn calves are infested; that this has been the worst winter for screw-worms he has experienced.

P. E. Williams (Davenport) was President of the Florida Livestock Association for 10 years, formerly a member of the Federal Livestock Advisory Committee. He stated that since last June the screw-worms have given him much more trouble than in any previous year; that there had been no let-up in infestations since last June, that it was not infrequent to have a few infestations in January and February, but they have never been so heavy as at the present time; that every injury is infested; that, because of the heavy infestations, he has been riding herd every day. He favored an eradication program.

W. L. Larkin (Dade City), stockman and lawyer, reported that screw-worms were worse this year than in any previous year; that it has been a continual battle since last June; that at least 80 percent of his calves were infested; that his losses from screw-worms included a \$1600.00 bull. He was strongly in favor of an eradication program and was willing to contribute cash to the venture. He assured the backing of the Pasco County Cattlemen's Association.

Marshall O. Watkins (Gainesville), Director, Florida Extension Service, stated that in his opinion, based on reports he had received and on what he had observed while hunting, an eradication program would be very much worthwhile. He promised the full cooperation of the Extension Service in an eradication program.

Lee Ellsworth (Deer Park), Manager, Orlando Livestock Company -- a Morman Church enterprise consisting of about 200,000 acres, where they expect to build up the cattle population to 50,000 head. There are probably over 30,000 head of cattle on the ranch at present. Mr. Ellsworth stated that he had considerable experience with cattle in several other states, but never saw anything as bad as the screw-worm; it was indeed the worst pest of livestock. He reported that over 50 percent of the calves were infested and has found many infested deer. He felt positive that an eradication program would be highly desirable "if only from the humane standpoint."

A. W. Birchwood (Holopaw), Manager, Triple E Feeding Operations, had 3,500 head of cattle on feed, but the usual number is about 5,500. Mr. Birchwood stated they had 3,000 brood cows and were getting about 100 calves per week, most of which became infested; in fact, practically all injuries are infested. He reported 12 infestations in cattle grub holes during the past week. Mr. Birchwood stated that the screw-worm was absolutely the worst pest of livestock and probably the most difficult of all livestock problems. He was strongly in favor of an eradication program.

C. C. Skipper (Orlando), Federal employee on the present screw-worm program, reported that wild-life has greatly increased in recent years, especially raccoons, and they breed more screw-worms than the woods hog. He stated that the game warden in Collier County reported finding 25 bucks (deer) infested with screw-worms.

Other personal contacts included Doctors Tissot and Kiekert, entomologists with the Florida Experiment Station, and Dr. Denmark, entomologist with the State Plant Board. They all ventured the opinion that the screw-worm has been a very serious pest during the past year.

The continued high screw-worm populations in Florida are due, for the most part, to the persistent warm temperatures and dry weather. Warm weather is, of course, of primary importance, but our studies and observations of former years have shown that in general we find most of the screw-worms on low, shaded ground during dry weather and on high well-drained ground during wet weather. Conversely, we find fewer screw-worms on low land during wet weather, and in high, well-drained areas during dry hot weather. Most of the higher, well-drained soils in Florida are used for the growing of citrus and other crops, and the lower, poorer drained soils are used for grazing. Consequently, the climatic conditions during the past 10 or more months have been favorable for the build-up and maintenance of high screw-worm populations.

Conferences

A conference was held with screw-worm research personnel and others at Orlando, including Dr. A. L. Lindquist, Head, Insects Affecting Man and Animals Section; Dr. T. H. Applewhite, in charge of Animal Disease Eradication Projects in Florida; Dr. C. L. Campbell, Florida State Veterinarian; Dr. J. O. Pearce, President, and J. R. Gunn, Secretary of the Florida

Cattlemen's Association. Dr. Lindquist and his associates discussed in detail the progress and present status of screw-worm research, expressing confidence in the probability of eradicating screw-worms from Florida by the systematic distribution of sterile male flies over the infested area.

Mr. Pearce insisted that a program should start immediately and read several letters from stockmen pointing up the severity of the present screw-worm situation. After being advised that an eradication program of this magnitude could not be started for several months, probably a year, he urged that a large-scale control operation be started at an early date on an area of about 2,000 square miles.

Dr. Campbell stated that the State Livestock Board would very probably contribute approximately \$22,000.00 for use in expanding present fly-rearing facilities and to help in financing operational expenses for a large test area.

Cole, Applewhite and Bruce spent half a day at the screw-worm rearing laboratory to study the methods and techniques for the mass production of screw-worm flies, then proceeded to Tampa and met with the State Livestock Board. Dr. Campbell presented the screw-worm problem and put particular emphasis on the immediate need for an extensive field test on some 2,000 square miles.

Pearce again urged getting the eradication program into action -- at least by next winter.

The Board members were unanimous in the opinion that the screw-worm was a serious pest of livestock and that an eradication program should be effectuated.

It was suggested by Board members that the request for State funds for an eradication program be co-sponsored by the State Livestock Board and the State Fresh-water Fish and Wildlife Agency. This met the approval of the Board members.

Screw-Worm Control

Screw-worm infestations in domestic livestock can be controlled if good livestock management practices are in effect and if adequate facilities are available for the proper handling of livestock. This means that livestock should be pastured in fenced areas, where they can be easily located and inspected to facilitate early detection and prompt treatment of infestations with approved remedies. On such farms and ranches, hospital pastures should be provided to confine injured animals where they can be observed and treated as necessary until the wounds are healed and safe from screw-worm attack. In Texas the treatment of screw-worms is taken more or less for granted as a routine chore of the stockman.

Of course, conditions in Florida are considerably different from the open plains of Texas and other large cattle raising areas. In Florida cattle and hogs graze over vast acreages of woodland where it is difficult, if not impossible, to find and treat all infested animals without extra-ordinary expense. It is admitted that some stockmen do not attempt to treat screw-worm infestations in Florida. This was more prevalent in the 1930's when the prices of livestock were low and many stockmen believed that the losses from screw-worm attack in animals were less than the cost of treating the animals. Now that the prices of livestock are much higher, losses are more acute and stockmen in general are making a fairly determined effort to treat all screw-worm cases they can find. Although in recent years there has been considerable improvement in the types of livestock grown in Florida and in the improvement and fencing of pastures, there are still a good many cattle and hogs that roam the woodlands and swamplands.

The effectiveness of a determined effort to control screw-worms in Florida was demonstrated in an Education and Control Program supervised by the Bureau of Entomology and Plant Quarantine and the Southern States from June 1, 1935 until the spring of 1938. During the first seven months of that period, i.e., from May 30 to Dec. 28, 1935, the number of reported infestations in Florida amounted to 153,000, or an average of 22,000 cases per month, with the known losses of 5,753 animals valued at \$21,281. At the conclusion of the program, in the spring of 1937, the record of infestations approximated 10 cases per week with no losses -- this in spite of the fact that rather crude remedies (benzol and pine tar oil) were used at that time. As near as can be remembered, this program was in effect during an average year with neither unusually warm or excessively cold winters. The Federal expenditures for the Screw-worm Educational Program in all the Southern States, for the period June 1, 1935 to about July 1, 1938, are recorded as follows:

Year	Field Operations	Education and Control	Research on Control	Totals
1935	\$ 6,000	\$ 49,589	\$ 4,411	\$ 60,000
1936	36,000	335,329	53,125	424,454
1937		327,318	30,070	357,388
1938	_____	<u>36,621</u>	_____	<u>36,621</u>
Totals	\$42,000	\$748,857	\$87,606	\$878,463

There are no available records to show the apportionment of these funds to the different states but, since most of the program activities were in Florida and Texas, it is reasonable to assume that a large portion of the funds were spent in those two states. There are no available records to show what additional funds were contributed by the several states; however, it is believed that Florida contributed approximately \$100,000.00.

The screw-worm situation in Florida as of the present date is much more serious than in previous winters because there has been no cold weather to check the activity and prevent the maintenance of high fly populations. Normally, the screw-worm over-winters only in peninsular Florida, in that area south of an east-west line half way between Gainesville and the Florida-Georgia line. Records show that one year in six or seven it is cold enough to kill out the screw-worm and limit overwintering to the southern half of the state. There have also been intermittent mild winters where there has been some screw-worm activity throughout the peninsular and in southern Georgia, but never so intensive as it has been during the winter of 1956-57.

It would be expected, therefore, that under average conditions, the screw-worm can be kept under control in domestic livestock although it must be admitted that under Florida conditions it is an extremely expensive operation.

Eradication of Screw-Worms from Florida

Recent developments in screw-worm research have stimulated intense interest in the possibility of eradicating screw-worms from the southeast. The successful eradication of screw-worms from the 170 square mile island of Curacao in 1954 and subsequent field tests in Florida have demonstrated that the systematic release of a predetermined number of sterile male flies per square mile can, very probably, eradicate screw-worm from any isolated area. More recently the development of improved techniques for the mass production of screw-worm flies has enhanced the probability of success in large-scale eradication operations.

There is yet to be developed a practical method of packaging, and distribution by aircraft, of the estimated 50 million flies per week that will be needed to effectuate an eradication program in the southeast. This should not be an insurmountable problem.

It is believed that the principal of eradicating screw-worms, by the use of sterile male flies to overwhelm the natural fly populations, is sound, and that the techniques and methods for the mass production of screw-worm flies are adequate for an eradication program in the southeast. Since the normal over-wintering area for screw-worms in the southeast is confined to peninsular Florida, it is obvious that most, if not all, of the eradication effort will be concentrated in that state.

Only a very few insects have ever been eradicated from any sizable area in the United States. It is doubtful if any eradication program was ever initiated with the definite assurance it would be 100 percent effective because of the many uncontrollable factors that enter into programs of such magnitude and complexity. It is believed, however, that screw-worms can be eradicated from the Southeast by the systematic dispersal of sterile male screw-worm flies over the infested area.

Consideration has been given to the fact that the screw-worm situation in Florida is much more complicated in extent of area, density of vegetation, and in livestock and wildlife populations than it was on the small island of Curacao, where eradication was accomplished. Nevertheless, we believe that a Federal-State cooperative program, using the principle, techniques, and methods developed by the Entomology Research Branch and the enforcement of the proposed quarantines, would effectuate eradication of screw-worms in Florida.

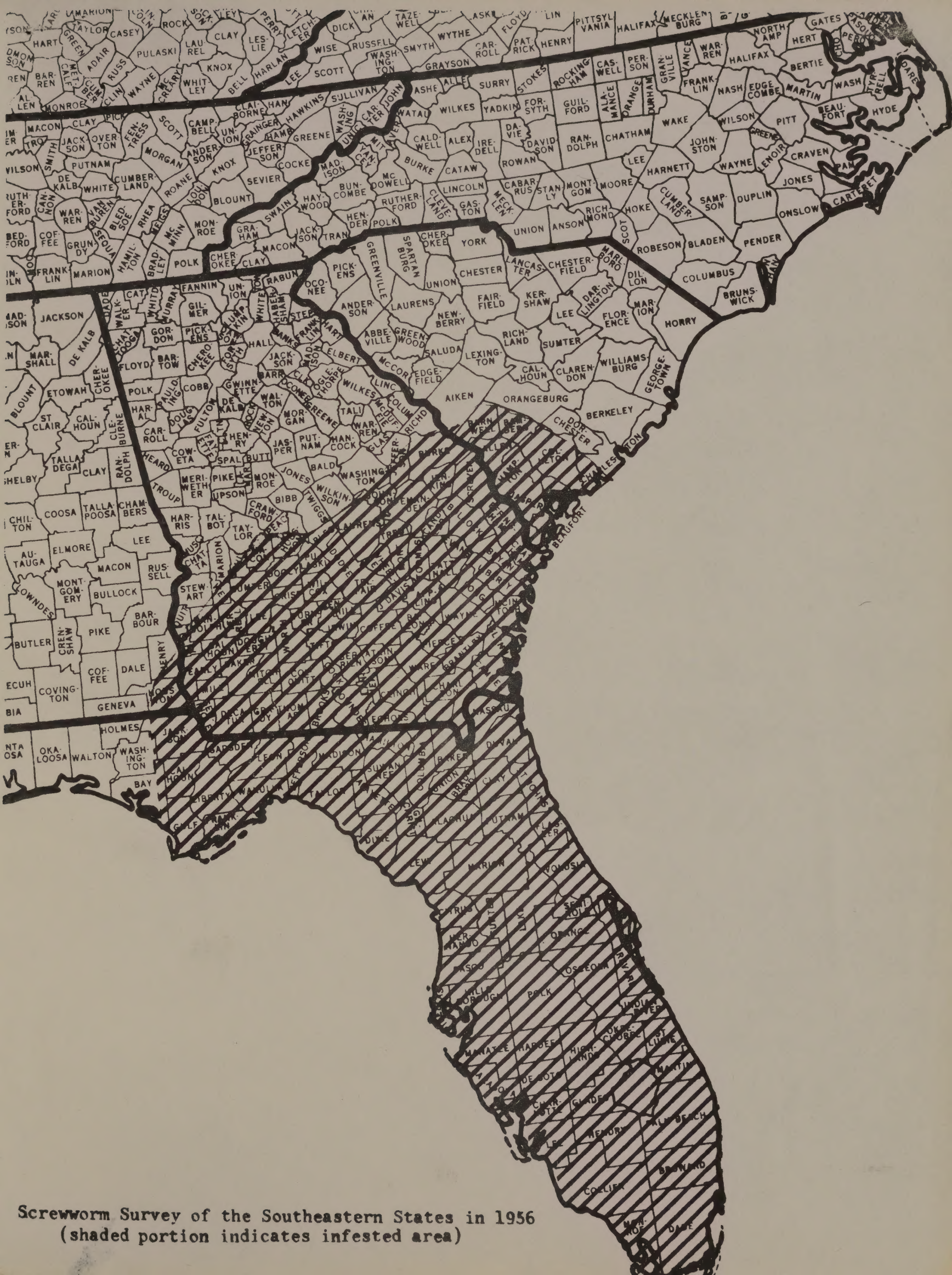
The estimated cost of an eradication program is 9 to 10 million dollars.

It is difficult to make a reasonably accurate estimate of the losses in Florida attributable to screw-worm attack. Such losses are not confined to the deaths of animals but include cost of labor to ride herd and treat infestations, cost of treating materials, stunted calves, loss of ears and eyes, etc. A minimum estimate would be about 10 million dollars annually.

Quarantines to Prevent Reinfestation

The success in maintaining freedom from reinfestation in the Southeast, after screw-worms have been eradicated from that area, would be in direct proportion to the effectiveness of quarantine measures in preventing the movement of infested animals into the screw-worm-free area and in the prompt eradication of incipient infestations. The safeguards proposed appear adequate to prevent the establishment of infestations in any sizable area in the Southeast. These include the rigid examination of all east-bound livestock at railroad and highway bridges and ferries across the Mississippi River from New Orleans to Memphis; the treatment of all wounds in animals; the use of field inspectors in the several states; the facilities to cope with incipient infestations.

The cost of maintaining the quarantine, after the completion of the eradication program, would approximate \$750,000 annually.



Screwworm Survey of the Southeastern States in 1956
(shaded portion indicates infested area)

